Report on the

Stock Assessment Review (STAR) Panel for Widow Rockfish and Spiny Dogfish

Prepared for:
The Center for Independent Experts

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EXECUTIVE SUMMARY

The Stock Assessment Review (STAR) Panel for widow rockfish and spiny dogfish took place at the Hotel Deca, 4505 NE 45th St, Seattle, from 11th to 15th July 2011. The review was hosted by NWFSC. For spiny dogfish, the Panel reached a point where agreement was reached on what would constitute base case runs and sensitivity tests, and what would go into decision tables. For widow rockfish the Panel and Advisors agreed that no base case assessment sufficiently reliable to support decision making was available at this time. The Panel made recommendations for necessary work to be undertaken such that a reliable assessment might be available in future. The STAT Team disagreed with this conclusion. Dealing with the disagreement is ongoing at the time of writing this (CIE) report.

For widow rockfish, the pre-STAR assessment was effectively an "update" of the 2009 assessment rather than a "full" assessment as required. The fundamental problem during the review was the inability to explore the model sufficiently well given restricted data availability and ability to change model structure. There was thus no ability to agree to a base case run, adequately explore uncertainty, or to progress to discussion on final sensitivity tests and decision tables. The modelling problems identified by the Panel are not new and have in fact been highlighted by previous STAR Panels. The widow rockfish assessment may be taken to the STAR "mop up" meeting in late September. It may not be possible to complete the necessary work in time for that meeting and a longer timescale may be warranted.

For spiny dogfish, the assessment reviewed was the first attempted. The assessment is fundamentally difficult because spiny dogfish has substantially been a by-catch fishery since about 1950 and is subject to high discarding. Knowledge of total removals is therefore limited and the high uncertainty about this is the major and overwhelming axis of uncertainty in estimates of interest to management. Dogfish biology is also different to that modelled in most assessments, and a novel approach to stock-recruitment modelling is used. Ageing is also a problem and the limited age data were dropped in the final assessment agreed during STAR 3. There is substantial work that might be undertaken on ageing, growth-modelling, and stock-recruit dynamics, and all are encouraged, but the primary need is to better define the removals history and appropriate alternative histories for sensitivity testing. Unless the removals history can be better defined, there is reduced benefit to be gained from improving biological knowledge and modelling approaches.

For spiny dogfish, exploration of the models was reasonably thorough and uncertainty seems to be well depicted. The models and methods used are fairly standard and I see no major causes for concern. A number of suggestions and recommendations are made. For widow rockfish exploration of the models as presented was reasonably thorough. However, the inability to consider potentially important data sets and to explore alternative model formulations was a cause for concern, leading to the Panel being unconvinced that the science was the best available and achievable. More work is needed before the widow rockfish assessment can be considered

the best available. The over-riding recommendation for widow rockfish is to complete a more comprehensive assessment.

BACKGROUND

Widow Rockfish

Widow rockfish (*Sebastes entomelas*) is a rockfish distributed from southeastern Alaska to Baja California, at depths from 25 to over 350 m and typically inhabiting rocky banks. The lifespan of widow rockfish is of the order of 30 to 35 years, reaching maturity at 5-8 years and with fecundity increasing with length/age. The assessment region for widow rockfish considered in this review covers the US west coast ranging from southern California, through Oregon to the USA-Canada border. Linkages with widow rockfish in Canadian and Mexican waters are assumed to be negligible.

Catches of widow rockfish of the order of 100 tonnes per year were first reported in California fisheries in 1916. Catches in Oregon and Washington as well as California developed during the war years totaling around 1,000 tonnes per year, with occasional higher peaks, before escalating rapidly in 1979 to 1981when catches reached 24,000 to 29,000 tonnes per year. Catches remained high until management measures were introduced in 2002. Since then, widow rockfish total catches have been restricted effectively to by-catch, notably in the at-sea whiting fishery.

The stock of widow rockfish was last assessed in 2009. At that time, the point estimate for depletion of the spawning output at the start of 2009 was 38.5%, having increased from a then estimated low of around 30% in 2001/2. The exploitation rate in 2009 was estimated to be below 1%. Widow rockfish is managed using the standard PFMC reference points of 40% B_0 (as a B_{msy} proxy) and 25% B_0. In 2009 the stock was assessed to be overfished but not subject to overfishing.

Although in 2009 the assessment was used to inform management, it is notable that the 2009 STAR Panel had major reservations about aspects of the assessment and made a number of recommendations for priority consideration. The adopted 2009 base case run was specified by the STAR Panel. However, the run was not completed and diagnostics and fits were not considered during the meeting.

Spiny Dogfish

Spiny Dogfish (*Squalus suckleyi*) is a small schooling shark with a lifespan of the order of 60 to 80 years and late maturity, starting at approximately 30 years. It is distributed from the Gulf of Alaska to southern Baja California though is most abundant off the coasts of Washington and British Columbia. The assessment region considered in this review covers the US west coast (California, Oregon and Washington). Although there are linkages with spiny dogfish in British Columbia these are assumed to be negligible in the assessment.

Only small catches of spiny dogfish are recorded (or reconstructed) in the assessment area between 1916 and the late 1930s. Catches increased markedly in the war years when spiny dogfish was targeted as a source of Vitamin A (found in the livers), reaching a peak of almost 17,000 tonnes in 1944. The "Vitamin A fishery" ended in 1950 due to lack of demand created by the development of synthetic vitamin alternatives. Although a limited food fish market existed from the mid 1970s until recent times, landings have been dominated by discards since 1950. In the period 2001 to 2010 trawl fishery discards have averaged 86% while hook and line discards have averaged 41%; in both fisheries, the discard percentage has increased during this period. Over the same period, the overall discard rate has averaged about 75%. Discards as well as landings have been the subject of reconstruction and are treated as separate fleets for stock assessment.

This is the first attempt to carry out a stock assessment for spiny dogfish in the U.S. There is currently no estimate of stock status and there is no spiny dogfish OFL or ACL. Rather, the species is part of an "other species" mix which is subject to a combined ACL. There is no currently accepted assessment of spiny dogfish in Canadian west coast waters. The life-history characteristics of *Squalus suckleyi* (long lifespan, slow growth, late maturity, long gestation period, low fecundity) mean that it has very low productivity. As it is also highly susceptible to capture in many fisheries, it is generally considered vulnerable to over-exploitation.

REVIEW PROCESS

ToR 7 *Provide a brief description on panel review proceedings highlighting pertinent discussions, issues, effectiveness, and recommendations*

The Stock Assessment Review (STAR) Panel for widow rockfish and spiny dogfish took place at the Hotel Deca, 4505 NE 45th St, Seattle, from 11th to 15th July 2011. The review was hosted by NWFSC.

Participants in the review are listed in Appendix 3. The STAR Panel comprised a PFMC SSC appointed Chair (Tsou), a NWFSC appointed reviewer (Spencer, AFSC) and two CIE reviewers (Cieri and Stokes). The rapporteurs (Spencer and Cieri) for the STAR Panel reports were appointed on the first morning during the opening session. The STAR Panel was tasked with providing separate reports for widow rockfish and spiny dogfish. Notification of the meeting and dissemination of papers followed closely the schedule laid out in the CIE Statement of Work (see Appendix 2). Materials were provided in advance *via* a dedicated ftp server (see Appendix 1). Overall, administration of the review was sound.

The Terms of Reference (ToR) for the review are given in Appendix 2, Annex 2. Often, reviews including CIE experts focus on a particular phase of the stock assessment process – either the data inputs or the assessment *per se*, and often deal only with a single stock. The ToR set for the

STAR 3 review (and other STAR meetings) is very wide, spanning for each of widow rockfish and spiny dogfish, data quality (including collection and analysis) and the stock assessment. For STAR 2 it was noted in a separate CIE report that given the scope of the ToR and review meeting, it was not possible to devote as much time as would be desirable to every issue area. This was not a major difficulty during STAR 3 and the Panel was able to review both stock assessments sufficiently well in the time available, given data available.

The meeting followed the general outline of the draft agenda (Appendix 2, Annex 3) but with sufficient flexibility to allow necessary responses from the two STAT. The STAR process involves the STAR Panel working with Advisors and the STAT not just to review data and assessments but also to agree to definitions of final decision tables. For spiny dogfish, the Panel reached a point where agreement was reached on what would constitute a base case run and sensitivity tests, and the states of nature and catch options to go into decision tables. Given time available, however, the final, specified base case run and sensitivity tests still needed to be run after the Panel meeting ended, and the final decision tables prepared. Although in general such an approach can be less than satisfactory, I do not envisage any problems in this case.

For widow rockfish, the Panel, working with Advisors and the STAT, reviewed data and assessments and concluded there were sufficient issues needing further exploration, and that it was not possible to accept the assessment as presented and explored as a full basis for supporting robust management decision making. The fundamental problem during the review was the inability to explore the model sufficiently well given restricted data availability and ability to change model structure. There was thus no ability to agree to a base case run, adequately explore uncertainty, or to progress to discussion on final sensitivity tests and decision tables. The modelling problems identified by the Panel are not new and have in fact been highlighted by previous STAR Panels. The 2011 STAR Panel, however, reached its conclusions independent of previous STAR Panel findings. Dealing with widow rockfish was difficult and discussions often strained. It was clearly difficult for the STAT member involved who had to deal with requests and discussions unaided (only one STAT member was present and away from his own Center). Not all requests were responded to and consideration of responses was often difficult with results presented raw as opposed to synthesized and simplified for presentation (as common for other stocks). It is always difficult logistically to ensure adequate coverage and location but given the clear problems and lack of attention to some issues raised by previous STAR Panels, it would have been advisable to undertake the widow rockfish review in Santa Cruz instead of Seattle.

As part of the STAR process it is required that statements of disagreement be reported. Final discussions on widow rockfish provided an opportunity to discuss areas of disagreement. A written statement of disagreement from the STAT, raising issues not discussed during the meeting and misinterpreting the Panel conclusions, was received on 21st July, 6 days after the STAR Panel ended. While it is fair to give opportunity for reasoned input and responses, it is difficult to run an orderly process and timely reporting with such delay. Accepting lengthy statements of disagreement without further opportunity for joint Panel consideration is also problematic. My hope is that the final Panel report will record the disagreement and that any

statement of disagreement, and Panel responses, would be included as appendices or, better still, simply made available to the SSC. At the time of writing this CIE report, it is still unclear how this process issue will be dealt with although discussions within the SSC GMT apparently have led to a decision to include widow rockfish in the "mop up" meeting in September.

The spiny dogfish STAT comprised staff from the NWFSC. The widow rockfish STAT comprised a single SWFSC staff member. Panel advisors included representatives from the PFMC Groundfish Management team (GMT) and Groundfish Advisory Panel (GAP). Due to an accident, the PFMC staff member (DeVore) was unfortunately unable to attend but did keep in contact by e-mail and phone. Other participants included NWFSC staff as well as fishing industry representatives and the public. I am not aware of any problems with notification of the meetings and interpret from the presence of stakeholder representatives and the public, and lack of complaint, that notification was appropriate. All participants were able to participate throughout the meeting and opportunity was explicitly and regularly given for input. Many non-Panel participants contributed usefully to discussion and I believe that all were provided appropriate opportunity for involvement both during the Panel meeting and during extra-mural discussions.

REVIEWER'S ROLE IN THE REVIEW ACTIVITIES

The role of the reviewer is set out in the CIE Statement of Work, Attachment A, attached here in Appendix 2, Attachment A. Both CIE reviewers are tasked with producing an independent report to the CIE. The reviewers are additionally tasked with contributing to Panel Reports for each of widow rockfish and spiny dogfish.

In addition to *becoming familiar with the draft stock assessments(s) and background materials* (**ToR 1**), I (Stokes) participated in all discussions and contributed (primarily editing) to draft Panel reports which were left with the Chair at close on 15th July for further work. As STAR 2 Panel reports were still to be completed when STAR 3 began, I avoided taking on additional STAR 3 rapporteur responsibilities and am grateful that other Panel members (Spencer and Cieri) did so. At the time of writing this (CIE) report, the STAR 3 (and STAR 2) Panel Reports have yet to be finalized.

SUMMARY OF FINDINGS BY STOCK

ToR 2

Widow Rockfish

General comment on pre-STAR document: The pre-STAR document outlining the STAT-proposed assessment (*6_Pre-STAR_Widow_Rockfish_Assessment_2011_He-et-al.pdf*; see ftp

site) did not fully explain reasons for analytical choices, rather concentrating on description. An example is the brief section on natural mortality (section 3.2.2) which merely states natural mortality is assumed constant at the same level as in previous assessments but offers no background to the estimate or its credibility. In addition, the section notes that for older ages an assumed higher constant value is used for the first time, effectively to compensate for the way in which the latest SS3 implementation deals with plus groups. There is no discussion on the issue or consideration of alternatives. The pre-STAR document also lacks complete sections on biological parameters, instead giving a very brief description of growth, ageing, maturity and fecundity – these are key issues, especially when reference points are based on spawning output and when differences in parameters are used to justify the use of a two-area model. Responses to 2009 STAR comments are also brief (section 3.4.1); a short appendix is included to examine one- *versus* two-area models but the examination is somewhat cursory. Indeed, given the way the simulation is set up (predicated on the assumed two-area base case assessment from 2009), the conclusions drawn are inevitable and perhaps not hugely informative. Notably lacking in the pre-STAR responses to the 2009 STAR is any comment about selectivity patterns or discussion on availability/utility of the still missing length composition data.

Stock structure: No information on stock structure was presented but the assumption of a single stock in US west coast waters seems reasonable. The splitting of the assessment into northern and southern zones based on observed differences in growth seems arbitrary and needs more careful consideration both from a fishery and biological perspective, and from an assessment/management one. It is worrying that no analyses or even simple data expositions are provided in support of the splits and that the only explanation of the issue appears briefly in a section on 'biological data' as *"Because widow rockfish grow and mature differently between the northern area (Washington and Oregon) the southern area (Eureka and Monterey), this assessment used a two-area assessment model. The northern and southern areas are conveniently delineated by the 43N. latitude line. All biological data, including growth, maturity, and fecundity, were therefore area-specific."*

Natural Mortality: Natural mortality is assumed constant and equal for males and females at a value used in previous stock assessments (0.125; unexplained). In the new pre-STAR assessment, a higher value (0.15) was assumed for ages greater than 25 years, not for biological reasons but rather as a technical response to changes in SS3. The values used appear consistent with standard (e.g. Hoenig) estimates given the apparent longevity of the species but more information is needed to justify the use of the constant (by age, sex and area) value(s) and to explore alternatives (e.g. age-structured natural mortality using the Lorenzen method available in SS3). Given the technical difficulties acknowledged in the pre-STAR document, and by high caliber research work by the main STAT author, of estimating natural mortality, especially when confounded by the way in which selectivity is parameterized, it might also be useful to consider external to the model ways in which natural mortality might be better estimated.

Steepness: For west coast assessments, steepness priors provided by Dorn (AFSC) are used in most cases. The priors are updates by Dorn and are used [as?] *pers. comm.* rather than being

published. During the STAR 2 review meeting a brief explanation was given and a spreadsheet provided to show calculations. In 2009, the prior used for widow rockfish had a median of 0.72 and a SD of 0.19. The new prior provided by Dorn spans 0.2-1.0 and is very highly skewed to the right, with a median of 0.79 and SD of 0.16. Use of this new, meta-analytically derived and updated prior, is appropriate. It is notable (below) that the model configuration chosen in the pre-STAR analyses is highly sensitive to the prior and weighting of composition data and especially to the structural assumptions relating to selectivity – the adopted constant steepness value of ~0.4 based on initial model exploration is therefore highly influential/constraining.

Length/Age/Growth: Growth is not estimated in the stock assessment but is externally estimated separately for males and females in northern and southern areas. There are no conditional age-length compositions provided to the model but it is unclear if any might be available to enable estimation of growth within the model. The analyses used to parameterize growth date from 1987 and 1991, a time during which fishery removals were high and following the brief but very high peak. There is no description of how representative the externally derived growth rates are or consideration of changes through time. Given that spawning output (a multiple of length, maturity and fecundity) is used in the key depletion reference point and that depletion is estimated relative to 1916, it would be useful to see more up-to-date analyses that also consider possible temporal and spatial variation.

Maturity/fecundity: There is no direct information on maturity/fecundity presented. The externally provided estimates are taken directly from the literature, deriving from 1987 and 1982 for maturity and fecundity respectively. In general, use of the most recent information is reasonable. However, if major changes have occurred in life history traits (or other biological/ecological aspects as also noted above in reference to length) then implications for reference points, especially when using spawning output, would need to be considered. The use of "virgin biomass" based reference points, especially when estimating virgin biomass in a period well before major fishing and data collection, is potentially misleading.

Surveys: Fishery independent indices are available from a mid-water juvenile trawl survey conducted annually between 2001 and 2009, triennial surveys conducted between 1980 and 2004, and from annual surveys conducted by the NWFSC between 1999 and 2010. The latter two surveys series were split into northern and southern regions for use in the two-area model following previously applied statistical methods. Little background is given on the surveys or their use in the main documentation; it is therefore difficult to assess the potential utility or appropriate use of each. The mid-water juvenile survey is intended to index rockfish (including widow rockfish) spawning and is the only potential information source on recent year-classes; it is, however, intentionally given low weight (by adoption of a high CV). Given the poor pre-STAR model fit to the index (high auto-correlation) this might be explored further. The triennial surveys are split between 1991/94 in other assessments because of changes to survey timing (occurring earlier from 1994 onwards), depth distribution (extending deeper from 1994) and geographic coverage (extending further south from 1994). For widow rockfish no temporal split is made but the index is split into north and south components. The lack of temporal split may or

may not be appropriate but very little discussion is provided. The reason given, that "there is no evidence to support a seasonal migration of widow rockfish that would affect availability" is not convincing and the primary reason for lack of temporal split seems to be that there is insufficient data to split on both time and area. For each of the triennial series relative biomass indices are calculated and length (but not age) frequency data are available to the model, again split spatially but not temporally. As for the triennial surveys, the NWFSC surveys are split into northern and southern component indices. However, widow rockfish are only rarely caught in the NWFSC and the derived indices appear almost identical. Although likely not representative of widow rockfish, age and length compositions for the NWFSC are available to the model. Overall, it appears worthwhile to consider use of the sparse survey data in a one-area model, allowing time rather than area splitting of the triennial surveys and aggregation of age and length compositions.

CPUE: CPUE are available for the Oregon bottom trawl fishery from 1984 to 2002 though regulatory changes and low catches effectively restrict the series to end in 1999. The derived CPUE index follows standard methods. Other CPUE are available from foreign and domestic by-catch fisheries, with indices again derived using standard approaches. No details of CPUE estimation are provided in the main document which rather refers to older documents. Given the history of the fishery and sparse fishery-independent data (only the early triennial surveys) during the period of high removals, the CPUE indices are potentially valuable. However, all series have low natural weighting and have little influence on model outcomes which are rather dominated by the way age composition, and potentially length, data are interpreted. Currently, though, it is hard to see any way of improving the provision of CPUE indices.

Removals: Total removals (landings and discards) are important, especially when virgin biomass based reference point are used. The widow rockfish assessment is standard in that productivity parameters are estimated using a complex model and fitting procedure for a period relatively late in the fishing history and then those parameters are applied in a simple accounting exercise, taking account of withdrawals (removals) over a prolonged period to estimate initial capital (virgin biomass) in 1916. Any uncertainty in removals can therefore be a major source of uncertainty in estimates of depletion (as a ratio of current to virgin biomass). For widow rockfish there is a long history of removals by foreign and domestic fleets, both as a target and as by-catch, and with variation in discarding rate. The main assessment document (pre-STAR) describes succinctly from where catch data are derived, though does not fully explain how or why and hence what uncertainties there may be. In previous Panels, it has been commented that a clearly separated data process would be useful to deliver to the stock assessment process a defined removals history with, where appropriate, an indication of uncertainty and alternate histories for sensitivity testing. No sensitivity runs related to removals were considered in the pre-STAR document but it is not clear from the document, nor from Panel discussions, how much uncertainty attaches to the reconstructed, recorded or assumed catches and discards. For future assessments it would be useful to be more explicit about problems in reconstructing and uncertainty about removals history.

Spiny Dogfish

Stock structure: It is known from tagging studies that US and Canadian stocks of spiny dogfish are linked. There is tagging information demonstrating movement between the US west coast stock of spiny dogfish and that in British Columbia. The rate of movement is likely significant from a genetic perspective but is small enough (given other uncertainties in e.g. removals data) that it is considered reasonable to assess the US west coast as a unit. Given the management and assessment history, it is reasonable to maintain US-only assessments to inform management.

Natural Mortality: Natural mortality is assumed constant for females and males at 0.064, based on the standard Hoenig relationship between total mortality and maximum age. The value was fixed and no attempts were made to estimate it (given the very short and sparse age data available). This is reasonable and appropriate (noting that likelihood profiling on natural mortality is also carried out) but it would be reasonable to explore alternatives (e.g. age-structured natural mortality using the Lorenzen method available in SS3).

Stock-recruit: A novel approach to modelling the stock recruitment relationship was used to account for the low productivity of spiny dogfish. The new function, recently made available in SS3, provides a more direct connection between spawning output and recruitment than the more familiar Beverton-Holt function. The new relationship is explained in the pre-STAR report and considerable discussion took place during STAR 3. Overall, the approach seems appropriate though is highly parameterized. The new function does not have a single parameter equivalent to steepness for the Beverton-Holt but the parameters can be chosen to tune the function to provide similar outputs to specific parameterizations of the Beverton-Holt function. This was done during STAR 3 as part of sensitivity testing. It is **recommended** that prior to the next assessment, a clear exposition of the new function, how it is parameterized, and the consequences of its use be developed.

Length/Age/Growth: Growth is estimated in the pre-STAR stock assessment separately for males and females. Data on length and age-at-length are available variously from commercial fisheries and surveys, albeit for few, recent years. Because dogfish do not have otoliths, spines are read to determine age. Unlike otoliths, however, spines are subject to wear and ageing is consequently difficult. Two different methods were used to deal with the issue of wear when reading spines, the one using a simple power relationship between age and spine diameter, the other using a more complex model assuming Von Bertalanffy growth and using a nonlinear mixed effects model. The two methods result in very different ageing results for older fish, with consequent differences in length-age relationships. As age composition data are used in the pre-STAR model to estimate growth, this difference is important. During STAR 3, because of difficulties in ageing and the very limited age-at-length data available, it was decided to drop age data form the assessment and to use externally modeled growth. This approach was sensible but there is clearly more work needed on both ageing and growth modeling (assumed Von Bertalanffy but not obviously appropriate). It is **recommended** that this be carried out prior to further full assessment.

Surveys: Five sets of fishery independent indices are available: AFSC triennial surveys conducted between 1980 and 2004, split from 1995 to create two series due to changes in survey timing and coverage; AFSC slope survey between 1997 and 2001; annual surveys conducted by the NWFSC between 2002 and 2010; and the IPHC annual longline survey (for Pacific halibut) between 1999 and 2010 (with 2000 missing). From the limited presentations during STAR 3, the indices appear to be sound. As a general comment applicable to all STAR reviews, survey results are briefly presented but it is unclear to what extent survey indices are reliable or have been reviewed. It is **suggested** that a single document outlining the analyses could be useful and might also be the subject of separate review. Similarly, a clear exposition of how sampling takes place and composition data are created would be useful and could provide insight as to appropriate weighting (for example, if there are correlations between tows, then the effective sample sizes might be over-stated).

CPUE: No CPUE indices were available for use in the model.

Removals: Total removals (landings and discards) are important, especially when virgin biomass-based reference points are used. The spiny dogfish assessment is fairly standard in that productivity parameters are estimated using a complex model and fitting procedure for a period relatively late in the fishing history and those parameters are then applied in a simple accounting exercise, taking account of removals (withdrawals) over a prolonged period to estimate initial capital (virgin biomass). Any uncertainty in removals can therefore be a major source of uncertainty in estimates of depletion (as a ratio of current to virgin biomass). In the case of spiny dogfish, removals can be broken down into a number of distinct periods, covering fisheries aimed at the valuable vitamin A fishery during the war years and just beyond, followed by a period of low catches until the mid to late 1970s and a revived fishery thereafter to service a European demand as well as cartilage for pharmaceutical purposes. Since about 1950, removals have been dominated by discards, principally from trawl fleets targeting groundfish but also in hook and line fisheries and the at sea hake fishery. A new reconstruction of catches, starting in 1916, has been used for the 2011 assessment. As for catch reconstructions for other stocks, it would be sensible to review fully those used for spiny dogfish. At the moment, the assessment can only proceed on the basis of available data. While it would be useful to have a better characterization of potential errors in catch series, the simple expedient of coarse sensitivity testing to major increases or decreases is all that can reasonably be done.

Discarding is reasonably assumed to be zero during the high value vitamin A fishery. Estimation of discards thereafter is a serious problem. Discard fractions and composition data exists from WCGOP observers, by state, from 2002 onwards. There are also very limited data from two discard studies off the Oregon coast during the 1980s. No apparent patterns exist for discarding by season or state, so a simple regression approach has been used with the WGCOP data to develop estimates of discards by year proportional to landings. This is applied back to 1950. Clearly, the time-blocking and general approaches are gross simplifications and there is likely substantial error in the estimates of discards used in the assessment. There is no information at

all on discard mortality and the assumption made of 100% mortality in trawl fisheries and 50% in hook and line is not unreasonable. The sensitivity tests to this assumption are very coarse.

As noted at STAR 2, it is unclear to what extent catch history reconstructions have been formally reviewed. It is **recommended** that there is a need formally to do so and to identify an accepted, definitive catch history and agreed sensitivity series. This recommendation applies not just to spiny dogfish but to all stocks. It is wasteful of valuable analytical time and resources to deal with the issue stock by stock. The recommendation applies equally if not more so in the case of spiny dogfish to estimates of discards for all stocks. Virgin biomass and hence depletion estimates, and future management, largely depends on these figures and their importance cannot be underestimated.

ToR 3 *Evaluate and comment on analytic methodologies.*

Widow Rockfish

The pre-STAR age-structured assessment model assumes a US west coast-wide stock of widow rockfish split by sex and two areas on the basis of different growth and productivity rates. Recruitment (at age 0) is a function of the combined area spawning potential and is distributed to the northern and southern sub-areas in a constant proportion (across years) estimated in the model. Natural mortality is assumed constant at a fixed value of 0.125 for ages up to 25 and 0.15 for ages 26 and greater. The plus group is fixed at 35. Growth by sex and area are assumed constant at fixed values. Fecundity and maturity schedules are also assumed constant and fixed by area. The catch history starts in 1916. Discard proportions are assumed constant for separate periods. Catches and age composition data are provided by fishery and observer data and compositions are provided from 2002 onwards; although age compositions are provided for fisheries, length compositions are not. Length compositions are provided for the triennial surveys and age and length compositions are provided for the NWFSC surveys. Abundance indices are provided for eight fleets/surveys. Informative priors derived from meta-analyses are provided for steepness (a Beverton-Holt stock recruitment relationship is assumed). The model estimates domed (on age) selectivity for five separate fisheries, and steepness.

The pre-STAR assessment of widow rockfish was implemented using Stock Synthesis 3 (version 3.20d). Stock Synthesis has been extensively used and the main software and extensions have been validated and documented. A test of the pre-STAR model using SS3 v3.20d and SS3 v3.03a, as used in 2009, shows small differences in fits but with the main difference in likelihood due to fits to the prior on steepness. The technical changes in fit may be small but the effect on the estimate of steepness (0.36 compared to 0.41) and hence on virgin spawning output and thence depletion (34.4% compared to 38.5%) is notable. A similar effect of using the more recent SS3 version has been noted previously (STAR 2, POP, when moving from an ADMB implementation to SS3 v3.21d) and remains of concern. During STAR 2 the issue of explaining the difference was not fully explored or resolved due to lack of time and the need to progress

exploration of the POP assessment. During STAR 3 the issue was again not pursued given more fundamental issues of concern.

The pre-STAR model was explored to the extent possible during STAR 3 using SS3. All model runs were to MPD only. Tuning of pre-STAR model runs followed standard procedures with multiple passes to refine index and especially composition weights, following suggestions also made during STAR 2009.

Overall, the general methodologies used are sound. The model and methods used are fairly standard and I see no major causes for concern except for i) the general (not widow rockfish specifically) need indicated above to resolve possible differences between estimates from models implemented in different SS3 versions and, ii) the specific need to explore more fully model assumptions, configurations, and data options outlined below (see ToR 4). It is important to distinguish at this point that there are no obvious problems of technical merit *per se*. Rather, the issues of concern with the widow rockfish assessment relate to the extent of exploration and consequent sufficiency of the assessment to fully inform management.

Spiny Dogfish

The STAR 3 agreed base case assessment model assumes a distinct US west coast-wide stock of spiny dogfish and uses removals data separated by sex and fleet, including discards as separate fleets. The removals history starts in 1916. Discard mortality rates are modelled externally and assumed to be linearly related to landings. Catches and compositions are provided by state and observer data and compositions are provided from 2002 onwards. Growth by sex is fixed using parameters from an early model run that included conditional age-at-length composition data. These data were dropped in the final agreed run due both to a) poor diagnostics and clear tensions between length and age data, and b) acknowledged problems with ageing. Natural mortality is fixed (at 0.064 for both males and females). The model estimates length-based selectivity for surveys and fisheries, domed for surveys to reflect the restricted spatial coverage of surveys relative to the population, domed also for mid-water and hook and line, and asymptotic for trawl fisheries. Equilibrium recruitment is estimated but the stock-recruitment parameters are fixed (for a novel recruitment function). The new stock-recruitment function is very different to the usually assumed Beverton-Holt function but the formulation and fixed parameters effectively emulate a Beverton-Holt function parameterized with steepness of 0.284. The assessment therefore fits only to survey index and length composition data. Generally, the indices are reasonably well fit and length composition fits are adequate.

The assessment of spiny dogfish was implemented using Stock Synthesis 3 (SS3; v3.21f). Stock Synthesis has been extensively used and the main software and extensions have been validated and documented. The stock assessment in 2011 is the first for spiny dogfish.

The model was explored using SS3. During STAR 3, all model runs were to MPD only. Tuning of model runs followed standard procedures with multiple passes to refine index and composition weights. A full MCMC has been conducted on the pre-STAR base case and there do not appear to be any major problems with convergence; none are expected with the defined base case if MCMC is run but this is not guaranteed. From the pre-STAR MCMC runs it appears that the approximation to the median of the MCMC posterior on depletion is unbiased. However, the MCMC posterior is wider, especially on the right tail. It is **suggested** that running an MCMC on the agreed base case would be worthwhile to check that the newly defined approximation to the median is still unbiased.

The model is complex and model selection difficult. Exploration of the surface was reasonably thorough and uncertainty (see below) seems to be well depicted around the base case. The model and methods used are fairly standard and I see no major causes for concern.

ToR 4 *Evaluate model assumptions, estimates, and major sources of uncertainty and provide constructive suggestions for improvements if technical deficiencies or additional major sources of uncertainty are identified.*

Widow Rockfish

Two major assumptions underpin the widow rockfish pre-STAR assessment. First, the model assumes a single US west coast stock with two sub-areas with different growth and productivity. This is based on observed differences in growth rate. Fisheries are assigned to distinct areas. The degree to which growth is different between areas, or continuously variable, or spatial overlap of fisheries across areas, is unclear. Simple requests for information to clarify these issues were not responded to during STAR 3. It remains unclear, therefore, whether the additional complexity of a two-area model is necessary biologically, functionally, or for assessment/management purposes. The simulation study reported in the pre-STAR document assumes a stock structure as currently assessed but does not fully explore how alternative structural assumptions might influence assessment model choices to inform management. Use of a one-area model, even if there are growth differences from north to south, might allow better use of the sparse data available on widow rockfish and fuller exploration of a one-area model is **recommended**.

Second, the model assumes that all commercial fishery and survey selectivity is dome-shaped on age. From first principles this is not expected at least for commercial trawl fisheries. The possibility cannot be ruled out, however, and it is recognized that given the simplification of model structure relative to biological and fishery characteristics, various selectivity patterns are feasible. However, no exploration of alternative selectivity formulations (e.g., asymptotic or dome-shaped, use of splines as available in SS3; length- *versus* age-based) was made and no compelling biological or fishery evidence or explanations were offered to support the strong, single assumption. Indeed, the primary justification seemed to be that it is what had been done previously; this is insufficient. Without further exploration of these major assumptions, using all available data, it was difficult to proceed further with evaluation of the stock assessment during STAR 3. As for the one-area

model, it is **recommended** that fuller exploration of selectivity options is explored, involving careful scrutiny of model fits and sensitivities.

During the STAR 3 meeting, multiple runs were requested to try to understand the relationships between selectivity (in various structural forms and based on age and/or length), steepness and natural mortality. It was clear that even within the narrow assumptions of the pre-STAR model there is high sensitivity to these parameters. There is very little information available to the complex model that can be used to estimate the interacting parameters (especially given the low catches following management measures in the past decade); the model can effectively choose to interpret the available data to provide widely varying estimates of productivity and hence virgin biomass and depletion.

The need is to investigate the trade-off between model complexity and management utility. Effectively, a "full" assessment, including review of all available data and consideration of a range of alternative model formulations is needed (see ToR 6).

Spiny Dogfish

The model assumes a single, distinct US west coast stock with no linkage to spiny dogfish beyond US waters. This is clearly a simplification. As noted in previous reports this is unlikely to be a major problem for assessment and management purposes unless linkages are such to render the stock-recruit assumptions (structural form and parameterization) invalid. Given the many sensitivities of the model due to fundamental matters such as removals, discard mortalities, age interpretation, estimation of natural mortality, use of novel stock-recruitment function, the issue of stock structure is not seen as a major problem. I do not disagree with the general Panel recommendation about possible joint assessment (USA and Canada) or exploring movement; I do not, however, see it as a major need compared to dealing with other sources of uncertainty (removals, ageing, growth).

The model uses substantial data sources, fitting to survey indices and length composition data, with many externally calculated parameters, to estimate a range of parameters and derived parameters of interest to management. The fits to length composition data are adequate but future use of age composition data may provide a better basis for future assessment. Fits to indices are acceptable though indices show little variation and have large CVs, and have relatively little impact on estimates of depletion. The exception to this is the NWFSC shelf-slope survey which is the primary source of information on current stock size and hence depletion. The impact of the survey can be seen in retrospective analyses and its continuation is clearly important.

Ageing is clearly a problem. Sorting out the ageing methods and growth estimation prior to the next full assessment should be a priority. There is time to do this as there is currently little age data available from fisheries or the NWFSC shelf-slope survey. Continuation of existing

explorations on ageing and growth appears likely to yield useful results on the time-scale over which composition data will be acquired.

The novel stock-recruit function used in the assessment needs to be better described and investigated but appears to be a sound approach. Understanding the relationship between the new function and the Beverton-Holt function is important. From discussion during STAR 3 it appears that this work is already underway.

It is unclear what assumptions are made with respect to estimates of historical landings in the reported reconstructions and whether the sensitivity tests conducted adequately capture true uncertainty both in the catch reconstructions and in discards. The tests do appear to cover extreme cases, as do the discard mortality rate tests. The quantum of removals has a large effect on estimates of virgin biomass, though not depletion. As noted above, at a minimum it would be useful formally to review catch reconstructions to provide confidence in their validity. In this case, it would be useful to ensure that discard estimation is a part of any wider catch reconstruction exercise.

Using the pre-STAR model, substantial sensitivity tests have been conducted to removals, discard mortality, selectivity assumptions, stock-recruitment parameterization (using the new stock-recruit functional form and Beverton-Holt), and growth forms (dependent on ageing method). Profiling on natural mortality has also been carried out for the new base case. The major axis of uncertainty seems to be the catch stream used and to a lesser extent natural mortality. If the catch stream uncertainty could be refined, it may be that the major axis would collapse to natural mortality.

The model assumes natural mortality is constant and equal for males and females. For a long-lived species such as spiny dogfish there is likely variation in natural mortality at age due to differences in growth of males and females. An exploration of age-related natural mortality and the implications of using it might be warranted. As SS3 allows for age-specific mortality and includes the ability to use length-dependent mortality, this is possibly a useful avenue for future investigation.

The final decision table has three defined states of nature with low, medium and high catch scenarios representing highly uncertain catch histories, primarily due to difficulties estimating catches in a largely by-catch fishery. The high and low states of nature are modified also to account for some variability in natural mortality. However, the catch stream uncertainty swamps other sources and the additional variation in natural mortality used to define the states of nature is small. If the catch stream uncertainty were to be reduced then there would be a need to expand the natural mortality range to represent true uncertainty along that axis. The base case and uncertainty envelope reasonably capture the current and possible future variations in depletion under alternate catch forecasts.

ToR 5 *Determine whether the science reviewed is considered to be the best scientific information available.*

Widow Rockfish

In my opinion, the pre-STAR assessment was effectively an "update" of the 2009 assessment. Some explorations were undertaken and changes made (e.g. in tuning) in response to STAR 2009 but the 2011 pre-STAR assessment nevertheless falls short of being a "full" assessment of widow rockfish. In particular, there is a need to more fully investigate the basis for one- *versus* two-area models, and to consider and either change or justify assumptions concerning selectivity. There is a need is to include all commercial length composition data to permit greater exploration of selectivity fitting options. There is also a need to consider alternative approaches to assuming and/or fitting natural mortality. Further, there is a need to consider possible uncertainty around removals. Overall, my sense is that the assessment *per se* could be formulated better to use available information or, if not, then a fuller justification of the previous models (for continuation) is needed to provide comfort that they are the best scientific information available. I am unconvinced that the necessary work can be completed in time for the STAR "mop up" meeting to be held in late September and would **recommend** the work be undertaken on a longer timescale.

Spiny Dogfish

In my opinion, the STAT initially, and in conjunction with the STAR Panel and advisors, has comprehensively reviewed the available information on spiny dogfish and has conducted thorough analyses to provide estimates of management-related quantities. Uncertainties in inputs and estimates of interest have been adequately explored and overall I am confident that the resulting assessments and decision tables represent the best scientific information available.

ToR 6 *Provide specific suggestions for future improvement in any relevant aspects of data collection and treatment, modeling approaches and technical issues.*

General

Given differences in bridging (i.e. "crossover" or "continuity") runs for POP during STAR 2 and widow rockfish during STAR 3, it is **suggested** that it may be useful to consider a simple comparison across SS3 implementations using standard data and assumptions for selected stocks. The POP and widow rockfish examples suggest cause for at least a simple analysis to explore if there is an issue requiring further analysis and, if so, possibly to identify likely technical SS3 implementation explanations and/or data/model-implementation interactions. I have quickly gone through the change-log for SS3 and cannot see any obvious places to concentrate.

Widow Rockfish

A comprehensive review of model structure and available data is required and **recommended**. It is **suggested** that any review should include *inter alia* consideration of one- *versus* two-areas models (including consideration of both biological and fishery data), availability of length composition data, the use of age- and/or length-based selectivities, rationale for the use of dome-shaped and/or asymptotic selectivity curves, uncertainty in removals (including discards), alternative natural mortality schedules, and the use of priors.

Spiny Dogfish

The most important areas for technical improvement in the model appear to be in ageing and growth modeling; these are interesting and are encouraged. However, no amount of technical improvement will outweigh the fundamental problem of better defining removals. Recent and future removals and catch compositions should be assured, and are encouraged, but the need, to the extent possible, is to refine and define agreed estimates of historical catch streams (both the best estimates and agreed sensitivity cases). As described, the STAT has already undertaken extensive analyses to identify the best available relationship between recent landings and discards and has applied that relationship to data back to 1950. The sensitivity tests around the estimated catch stream, however, are large, arbitrary and unexplained. It is **recommended** that further examination is needed of the reliability of extrapolating the ladings to discard relationship back to 1950. Further, more careful consideration of possible bounds for sensitivity testing is needed. Given data explorations to date it is hard to see progress in this area except through interview techniques.

CONCLUSIONS AND RECOMMENDATIONS

Because of the wide scope (two stocks, consideration of both data collection and analysis, and stock assessment), it is highly likely that misinterpretation of some materials, presentations or discussions has been made. This is the fault of the reviewer, not of the many excellent STAT scientists who gave good presentations and made the review an enjoyable experience – to them, many thanks. As noted previously, the US west coast FSCs are in the enviable position of having many excellent scientists doing good work and providing support to the PFMC.

The STAR Panel system is well established and I am reluctant to criticize it on the basis of one or two meetings. My view may change over the course of the 2011 Panel meetings. My initial view that reviewing two entire stock assessments and all data inputs in one week, using the same Panel, is too frenetic, generally stands because there is restricted, perhaps insufficient, time to do justice to the substantial efforts of the STATs and to review in detail all necessary aspects.

The STAR 3 review wide in scope but there was time to have considered in sufficient detail both widow rockfish and spiny dogfish assessments and ancillary data inputs. The impediments to

progress on widow rockfish were more to do with data availability, and possibly the STAT being away from home base with limited resources, rather than time limitation. There remains a need to reconsider and review in detail many of the assessment inputs, assumptions, estimates and conclusions for widow rockfish. For spiny dogfish, though a new assessment, the final, agreed assessment, uncertainty, and emergent management advice were reasonably explored and represent the best scientific information available at this time.

Specific recommendations and suggestions are highlighted in **bold, red** in the preceding sections. I distinguish between recommendations as necessary activities and suggestions as desirable ones, recognizing that research planning and prioritization requires consideration of multiple factors and applies to many stocks, fisheries and other factors.

APPENDIX 1

BIBLIOGRAPHY

Prior to the Workshop, extensive materials were provided *via* a dedicated, anonymous ftp server (ftp.pcouncil.org/pub/GF_STAR_3_Widow_SpinyDogfish_July_11-15). The materials were extensive and relevant to all terms of reference in varying degrees.

During the workshop multiple presentations were given, and additional materials were provided on request, including further background documents and presentations as well as responses to Panel requests. All files were made available using the dedicated server which was accessed using hotel guest Wi-Fi throughout the meeting. The access was generally adequate. Directory listings are not provided here as the server is anonymous (and therefore publicly available).

APPENDIX 2

Attachment A: Statement of Work for Dr. Kevin Stokes

External Independent Peer Review by the Center for Independent Experts

Stock Assessment Review (STAR) Panel for Widow Rockfish and Spiny Dogfish

Scope of Work and CIE Process: The National Marine Fisheries Service's (NMFS) Office of Science and Technology coordinates and manages a contract providing external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of NMFS scientific projects. The Statement of Work (SoW) described herein was established by the NMFS Project Contact and Contracting Officer's Technical Representative (COTR), and reviewed by CIE for compliance with their policy for providing independent expertise that can provide impartial and independent peer review without conflicts of interest. CIE reviewers are selected by the CIE Steering Committee and CIE Coordination Team to conduct the independent peer review of NMFS science in compliance the predetermined Terms of Reference (ToRs) of the peer review. Each CIE reviewer is contracted to deliver an independent peer review report to be approved by the CIE Steering Committee and the report is to be formatted with content requirements as specified in **Annex 1**. This SoW describes the work tasks and deliverables of the CIE reviewer for conducting an independent peer review of the following NMFS project. Further information on the CIE process can be obtained from www.ciereviews.org.

Project Description: A full assessment of widow rockfish was conducted in 2009, which indicated that the stock should be rebuilt soon. However the STAR panel identified further exploration of model properties and alternative formulations as a priority and therefore recommended a benchmark assessment in 2011. The assessment for spiny dogfish represents the first effort to assess this species, which is subject to limited targeting and a high amount of fishery discards. Spiny dogfish has been proposed previously and received one of the highest vulnerability scores in the Pacific Fishery Management Council's GMT's recent vulnerability analysis. These two stock assessments will provide the basis for the management of the groundfish fisheries off the West Coast of the U.S. including providing scientific basis for setting OFLs and ABCs as mandated by the Magnuson-Stevens Act. The technical review will take place during a formal, public, multiple-day meeting of fishery stock assessment experts. Participation of external, independent reviewer is an essential part of the review process. The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**. The tentative agenda of the panel review meeting is attached in **Annex 3**.

Requirements for CIE Reviewers: Two CIE reviewers shall conduct an impartial and independent peer review in accordance with the SoW and ToRs herein. One of the CIE reviewers will participate in all STAR panels held in 2011, except for the than Pacific hake, to provide a level of consistency between the STAR panels. Reviewers should have expertise in fish population dynamics, with experience in the integrated analysis modeling approach, using age-and size-structured models, use of MCMC to develop confidence intervals, and use of Generalized Linear Models in stock assessment models. Each CIE reviewer's duties shall not exceed a maximum of 14 days to complete all work tasks of the peer review described herein.

Location of Peer Review: Each CIE reviewer shall conduct an independent peer review during the panel review meeting scheduled Seattle, Washington during the tentative dates of 11-15 July, 2011.

Statement of Tasks: Each CIE reviewers shall complete the following tasks in accordance with the SoW and Schedule of Milestones and Deliverables herein.

Prior to the Peer Review: Upon completion of the CIE reviewer selection by the CIE Steering Committee, the CIE shall provide the CIE reviewer information (full name, title, affiliation, country, address, email) to the COTR, who forwards this information to the NMFS Project Contact no later the date specified in the Schedule of Milestones and Deliverables. The CIE is responsible for providing the SoW and ToRs to the CIE reviewers. The NMFS Project

Contact is responsible for providing the CIE reviewers with the background documents, reports, foreign national security clearance, and other information concerning pertinent meeting arrangements. The NMFS Project Contact is also responsible for providing the Chair a copy of the SoW in advance of the panel review meeting. Any changes to the SoW or ToRs must be made through the COTR prior to the commencement of the peer review.

Foreign National Security Clearance: When CIE reviewers participate during a panel review meeting at a government facility, the NMFS Project Contact is responsible for obtaining the Foreign National Security Clearance approval for CIE reviewers who are non-US citizens. For this reason, the CIE reviewers shall provide requested information (e.g., first and last name, contact information, gender, birth date, passport number, country of passport, travel dates, country of citizenship, country of current residence, and home country) to the NMFS Project Contact for the purpose of their security clearance, and this information shall be submitted at least 30 days before the peer review in accordance with the NOAA Deemed Export Technology Control Program NAO 207-12 regulations available at the Deemed Exports NAO website: http://deemedexports.noaa.gov/sponsor.html).

Pre-review Background Documents: Two weeks before the peer review, the NMFS Project Contact will send (by electronic mail or make available at an FTP site) to the CIE reviewers the necessary background information and reports for the peer review. In the case where the documents need to be mailed, the NMFS Project Contact will consult with the CIE Lead Coordinator on where to send documents. CIE reviewers are responsible only for the pre-review documents that are delivered to the reviewer in accordance to the SoW scheduled deadlines specified herein. The CIE reviewers shall read all documents in preparation for the peer review.
Documents to be provided to the CIE reviewers prior to the STAR Panel meeting include:

- The current draft stock assessment reports;
- Previous stock assessments and STAR Panel reports for widow rockfish;
- The Pacific Fishery Management Council's Scientific and Statistical Committee's Terms of Reference for Stock Assessments and STAR Panel Reviews;
- Stock Synthesis (SS) Documentation
- Additional supporting documents as available.
- An electronic copy of the data, the parameters, and the model used for the assessments (if requested by reviewer).

Panel Review Meeting: Each CIE reviewer shall conduct the independent peer review in accordance with the SoW and ToRs, and shall not serve in any other role unless specified herein. **Modifications to the SoW and ToRs can not be made during the peer review, and any SoW or ToRs modifications prior to the peer review shall be approved by the COTR and CIE Lead Coordinator.** Each CIE reviewer shall actively participate in a professional and respectful manner as a member of the meeting review panel, and their peer review tasks shall be focused on the ToRs as specified herein. The NMFS Project Contact is responsible for any facility arrangements (e.g., conference room for panel review meetings or teleconference arrangements). The NMFS Project Contact is responsible for ensuring that the Chair understands the contractual role of the CIE reviewers as specified herein. The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements, including the meeting facility arrangements.

Contract Deliverables - Independent CIE Peer Review Reports: Each CIE reviewer shall complete an independent peer review report in accordance with the SoW. Each CIE reviewer shall complete the independent peer review according to required format and content as described in Annex 1. Each CIE reviewer shall complete the independent peer review addressing each ToR as described in Annex 2.

Other Tasks – Contribution to Summary Report: Each CIE reviewer may assist the Chair of the panel review meeting with contributions to the Summary Report, based on the terms of reference of the review. Each CIE reviewer is not required to reach a consensus, and should provide a brief summary of the reviewer's views on the summary of findings and conclusions reached by the review panel in accordance with the ToRs.

Specific Tasks for CIE Reviewers: The following chronological list of tasks shall be completed by each CIE reviewer in a timely manner as specified in the **Schedule of Milestones and Deliverables**.

1) Conduct necessary pre-review preparations, including the review of background material and reports provided by the NMFS Project Contact in advance of the peer review.
2) Participate during the panel review meeting in Seattle, Washington during the dates of 11-15 July 2011 as specified herein, and conduct an independent peer review in accordance with the ToRs (**Annex 2**).
3) No later than 29 July 2011, each CIE reviewer shall submit an independent peer review report addressed to the "Center for Independent Experts," and sent to Mr. Manoj Shivlani, CIE Lead Coordinator, via email to shivlanim@bellsouth.net, and to Dr. David Die, CIE Regional Coordinator, via email to ddie@rsmas.miami.edu. Each CIE report shall be written using the format and content requirements specified in **Annex 1**, and address each ToR in **Annex 2**.

Schedule of Milestones and Deliverables: CIE shall complete the tasks and deliverables described in this SoW in accordance with the following schedule.

6 June 2011	CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact
27 June 2011	NMFS Project Contact sends the CIE Reviewers the pre-review documents
11-15 July 2011	Each reviewer participates and conducts an independent peer review during the panel review meeting
29 July 2011	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
12 August 2011	CIE submits CIE independent peer review reports to the COTR
19 August 2011	The COTR distributes the final CIE reports to the NMFS Project Contact and regional Center Director

Modifications to the Statement of Work: Requests to modify this SoW must be approved by the Contracting Officer at least 15 working days prior to making any permanent substitutions. The Contracting Officer will notify the COTR within 10 working days after receipt of all required information of the decision on substitutions. The COTR can approve changes to the milestone dates, list of pre-review documents, and ToRs within the SoW as long as the role and ability of the CIE reviewers to complete the deliverable in accordance with the SoW is not adversely impacted. The SoW and ToRs shall not be changed once the peer review has begun.

Acceptance of Deliverables: Upon review and acceptance of the CIE independent peer review reports by the CIE Lead Coordinator, Regional Coordinator, and Steering Committee, these reports shall be sent to the COTR for final approval as contract deliverables based on compliance with the SoW and ToRs. As specified in the Schedule of Milestones and Deliverables, the CIE shall send via e-mail the contract deliverables (CIE independent peer review reports) to the COTR (William Michaels, via William.Michaels@noaa.gov).

Applicable Performance Standards: The contract is successfully completed when the COTR provides final approval of the contract deliverables. The acceptance of the contract deliverables shall be based on three performance standards:
(1) each CIE report shall completed with the format and content in accordance with **Annex 1**,
(2) each CIE report shall address each ToR as specified in **Annex 2**,
(3) the CIE reports shall be delivered in a timely manner as specified in the schedule of milestones and deliverables.

Distribution of Approved Deliverables: Upon acceptance by the COTR, the CIE Lead Coordinator shall send via e-mail the final CIE reports in *.PDF format to the COTR. The COTR will distribute the CIE reports to the NMFS Project Contact and Center Director.

Support Personnel:

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Annex 1: Format and Contents of CIE Independent Peer Review Report

1. The CIE independent report shall be prefaced with an Executive Summary providing a concise summary of the findings and recommendations, and specify whether the science reviewed is the best scientific information available.

2. The main body of the reviewer report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Summary of Findings for each ToR in which the weaknesses and strengths are described, and Conclusions and Recommendations in accordance with the ToRs.

   a. Reviewers should describe in their own words the review activities completed during the panel review meeting, including providing a brief summary of findings, of the science, conclusions, and recommendations.

   b. Reviewers should discuss their independent views on each ToR even if these were consistent with those of other panelists, and especially where there were divergent views.

   c. Reviewers should elaborate on any points raised in the Summary Report that they feel might require further clarification.

   d. Reviewers shall provide a critique of the NMFS review process, including suggestions for improvements of both process and products.

   e. The CIE independent report shall be a stand-alone document for others to understand the weaknesses and strengths of the science reviewed, regardless of whether or not they read the summary report. The CIE independent report shall be an independent peer review of each ToRs, and shall not simply repeat the contents of the summary report.

3. The reviewer report shall include the following appendices:

   Appendix 1: Bibliography of materials provided for review
   Appendix 2: A copy of the CIE Statement of Work
   Appendix 3: Panel Membership or other pertinent information from the panel review meeting.

Annex 2: Terms of Reference for the Peer Review

Stock Assessment Review (STAR) Panel for Widow Rockfish and Spiny Dogfish

1. Become familiar with the draft stock assessment and background materials.
2. Comment on the quality of data used in the assessments including data collection and processing.
3. Evaluate and comment on analytic methodologies.
4. Evaluate model assumptions, estimates, and major sources of uncertainty and provide constructive suggestions for improvements if technical deficiencies or additional major sources of uncertainty are identified.
5. Determine whether the science reviewed is considered to be the best scientific information available.
6. Provide specific suggestions for future improvement in any relevant aspects of data collection and treatment, modeling approaches and technical issues.
7. Provide a brief description on panel review proceedings highlighting pertinent discussions, issues, effectiveness, and recommendations

Annex 3: Tentative Agenda

Stock Assessment Review (STAR) Panel for
Widow Rockfish and Spiny Dogfish

July 11-15, 2011
Hotel Deca
4507 Brooklyn Avenue NE
Seattle, WA 98105

Monday, July 11, 2011

9:00 a.m.	Welcome and Introductions
9:15 a.m.	Review the Draft Agenda and Discussion of Meeting Format (Panel Chair)
	- Review Terms of Reference for Assessment and Review Panel
	- Assignment of reporting duties
	- Discuss and agree to format for the final assessment document
9:45 a.m.	Stock Assessment Team (STAT-1) Presentation of Species 1 (Authors)
	- Overview of Data and Stock Synthesis Modeling
12:30 p.m.	Lunch (On Your Own)
1:30 p.m.	Q&A session with the STAT-1 & Panel discussion
3:30 p.m.	Coffee Break
3:45 p.m.	Panel develops request for additional model runs / analyses for STAT 1
4:30 p.m.	Panel provides written requests for additional model runs / analyses to STAT 1
5:00 p.m.	Adjourn for day.

Tuesday, July 12, 2011

9:00 a.m.	Stock Assessment Team (STAT-2) Presentation of Species 2 (Authors)
	- Overview of Data and Stock Synthesis Modeling
12:00 p.m.	Lunch (On Your Own)
1:30 p.m.	Q&A session with the STAT-2 & Panel discussion
3:00 p.m.	Coffee Break
3:15 p.m.	Panel develops request for additional model runs / analyses for STAT 2
4:00 p.m.	Panel provides written requests for additional model runs / analyses to STAT 2
4:30 p.m.	Panel check in with STAT-1 if needed
5:00 p.m.	Adjourn for day.

Stock Assessment Review (STAR) Panel for
Widow Rockfish and Spiny Dogfish

Wednesday, July 13, 2011

9:00 a.m.	STAT-1 Presentation of first set of model runs for Species 1
	- Q&A session with the STAT-1 & Panel discussion
	- Panel develops written request for second round of model runs / analyses for STAT 1
12:00 p.m.	Lunch (On Your Own)
1:30 p.m.	STAT-2 Presentation of first set of model runs for Species 2
	- Q&A session with the STAT-2 & Panel discussion
	- Panel develops written request for second round of model runs / analyses for STAT 2
3:30 p.m.	Coffee Break
3:45 p.m.	Continue Panel discussion with STAT-2
5:00 p.m.	Adjourn for day.

Thursday, July 14, 2011

9:00 a.m.	STAT-1 Presentation of Second Set of Model Runs for Species 1
	- Q&A session with the STAT-1 & Panel discussion
	- Identification of preferred model and elements for the decision table.
	- Panel develops third list of model runs for decision table and begins drafting STAR report.
12:00 p.m.	Lunch (On Your Own)
1:00 p.m.	STAT-2 Presentation of Second Set of Model Runs for Species 2
	- Q&A session with the STAT-2 & Panel discussion
	- Identification of preferrred model and elements for the decision table.
	- Panel develops third list of model runs for decision table and begins drafting STAR report.
3:30 p.m.	Coffee Break
3:45 p.m.	Panel discussion or report drafting continues
5:00 p.m.	Adjourn for day.

Friday, July 15, 2011

9:00 a.m.	Consideration of remaining issues
	- Review decision tables for Species 1 and Species 2
11:00 a.m.	Panel agrees to process for completing final STAR report by Council's September meeting Briefing Book deadline
5:00 p.m.	Review Panel Adjourn.

APPENDIX 3
PERTINENT INFORMATION FROM THE REVIEW
1) Participants List

Technical Reviewers
Theresa Tsou, Panel Chair, Scientific and Statistical Committee (SSC)
Kevin Stokes, Center for Independent Experts (CIE)
Matthew Cieri, Center for Independent Experts (CIE)
Paul Spencer, Alaska Fisheries Science Center

Panel Advisors
John DeVore, Pacific Fishery Management Council (PFMC) Staff
Jason Cope, PFMC Groundfish Management Team (GMT)
Gerry Richter, PFMC Groundfish Advisory Subpanel (GAP)

Stock Assessment (STAT) Teams
Xi He, NMFS, Southwest Fisheries Science Center, Widow rockfish STAT
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